Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/398
AUSTRIA
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

IRRADIATION BEHAVIOUR OF COATED FUEL PARTICLES

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In order to obtain information on the behaviour of coated fuel particles under reactor conditions a series of capsule tests was performed in the ASTRA-reactor at thermal flux levels of $3 - 6 \times 10^{13}$ n/cm^2 sec. The burn-up achieved was about 10% fifa at operating temperatures of 1200 - 1400°C.

For these burn-up experiments two types of capsules have been used. One employed a graphite insert which was thermally insulated against the stainless steel containment by a helium gap. The other type utilized a niobium insert thermally insulated by Al_2O_3 powder. Both inserts contained the particles in an annular gap. The fuel temperature was monitored by high temperature thermocouples located at both sides of the fuelled annulus. With this arrangement data of the thermal conductivity of a loose packing of coated particles were obtained.

After dismantling the capsules in the hot cell the burn-up was determined by evaluation of cobalt dosimeters and by mass-spectrometric analysis of the uranium isotopes. This measurement was performed by using a high temperature ion source in which the uranium ions were obtained by surface ionization after a volatilization by a halogen treatment.

After a visual inspection and a metallographical examination the integrity of the particles was checked by two methods. The first utilized a zenon release measurement on reactivated particles to obtain the number of failed particles. The second used a chlorination process which allows the quantitative removal of uranium from failed particles via the volatile chloride.

By analysing the insert of the capsule the amount of non-gaseous fission products released during the experiments was determined by radiochemical methods and in some cases by gamma-spectrometry.

The results of the high temperature burn-up tests are given and correlated with the results of a preirradiation evaluation of coated particles produced by different methods.